Shanghai Jiao Tong University

MA280 Probability

Instructor Information:	TBD		
Term:	December 16, 2019 - January 7, 2020	**Credits:**	4 units
Class Hours:	Monday through Friday, 160 mins per teaching day		
Discussion Sessions:	2 hours each week, conducted by teaching assistant(s)		
Total Contact Hours:	64 contact hours (1 contact hour = 45 mins, 2880 mins in total)		
Required Texts (with ISBN):	N/A		
Prerequisite:	Students are expected to pass Calculus Extension Studies, Linear Algebra Extension Studies, UMEP Maths for High Achieving Students, one of Linear Algebra and Accelerated Mathematics 1 and one of Calculus 2 and accelerated Mathematics 2.		

Course Overview

This subject offers a thorough grounding in the basic concepts of mathematical probability and probabilistic modelling. Topics covered include random experiments and sample spaces, probability axioms and theorems, discrete and continuous random variables/distributions (including measures of location, spread and shape), expectations and generating functions, independence of random variables and measures of dependence (covariance and correlation), methods for deriving the distributions of transformations of random variables or approximations for them (including the central limit theorem).

The probability distributions and models discussed in the subject arise frequently in real world applications. These include a number of widely used one- and two-dimensional (particularly the bivariate normal) distributions and also fundamental probability models such as Poisson processes and Markov chains.

Course Goals

On completion of this subject students should

1. Have a systematic understanding of the basic concepts of probability space, probability distribution, random variable (including the bivariate case) and expectation;
2. Be able to use conditional expectations, generating functions and other basic techniques taught in the subject;
3. Be able to interpret a number of important probabilistic models, including simple random processes such as the Poisson process and finite discrete time Markov chains, and appreciate their relevance to real world problems;
4. Be able to formalize simple real-life situations involving uncertainty in the form of standard probabilistic models and to analyse the latter;
5. Develop understanding of the relevance of the probabilistic models from the subject to the important areas of applications such as statistics and actuarial studies.

General Skills

In addition to learning specific skills that will assist students in their future careers in science, they will have the opportunity to develop generic skills that will assist them in any future career path. These include

1. Problem-solving skills: the ability to engage with unfamiliar problems and identify relevant solution strategies;
2. Analytical skills: the ability to construct and express logical arguments and to work in abstract or general terms to increase the clarity and efficiency of analysis;
3. Collaborative skills: the ability to work in a team;
4. Time management skills: the ability to meet regular deadlines while balancing competing commitments;
5. Computer skills: the ability to use mathematical computing packages.

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Grading Policy

Assignments	20%
Participation	10%
Midterm Exam	35%
Final Exam	35%

Grading Scale

Number grade	Letter grade	GPA
90-100	A	4.0
85-89	A-	3.7
80-84	B+	3.3
75-79	B	3.0
70-74	B-	2.7
67-69	C+	2.3
65-66	C	2.0
62-64	C-	1.7
60-61	D	1.0
≤59	F (Failure)	0

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Class Schedule

Date	Lecture
Day 1	Introduction to Probability
Day 2	Sample Space and Events
Day 3	Probability Axioms & Theorems
Day 4	Conditional Probability and Independence
Day 5	Random Variables and Distribution Functions
Day 6	Expectation of discrete random variables, continuous random variables & functions of random variables (Assignment 1 due)
Day 7	Bernoulli random variables, mean and variance, Binomial random variables, distribution, mean and variance & Geometric random variables, distribution, mean and variance
Day 8	**Midterm Exam**
Day 9	Memoryless property for geometric distributions, Extended binomial theorem & Poisson approximation to the binomial
Day 10	Other Special Probability Distributions
Day 11	Bivariate Random Variables I
Day 12	Bivariate Random Variables II (Assignment 2 due)
Day 13	Sums of Independent Random Variables and Limit Theorems
Day 14	Stochastic Processes
Day 15	**Final Exam**